03 Biodiversity and Conservation

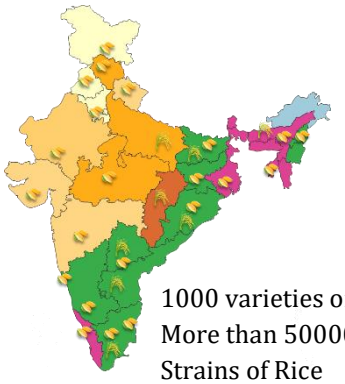
1. Introduction to Biodiversity :

Biodiversity is the term popularised by the sociobiologist Edward Wilson to describe the combined diversity at all the levels of biological organisation.

Edward Wilson

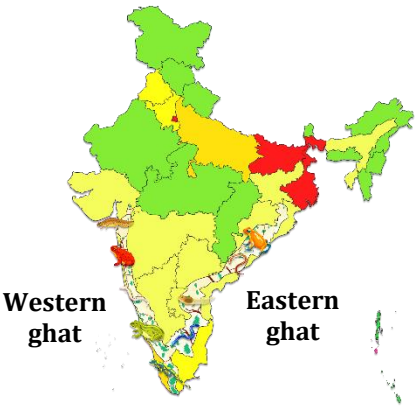
The most important of them are–

(i) **Genetic diversity:** A single species might show high diversity at the genetic level over its distributional range. The genetic variation shown by the medicinal plant ***Rauwolfia vomitoria*** growing in different Himalayan ranges might be in terms of the potency and concentration of the active chemical **(reserpine)** that the plant produces. India has more than **50,000** genetically different strains of rice, and **1,000** varieties of mango.



1000 varieties of Mango
More than 50000 different Strains of Rice

(ii) **Species diversity:** The diversity at the species level. For example, the Western Ghats have a greater amphibian species diversity than the Eastern Ghats.



(iii) **Ecological diversity:** At the ecosystem level, India, for instance, with its deserts, rain forests, mangroves, coral reefs, wetlands, estuaries, and alpine meadows has a greater ecosystem diversity than a Scandinavian country like Norway.

(A) How Many Species are there on Earth and How Many in India :

1. According to the IUCN (2004), the total number of plant and animal species described so far is slightly more than **1.5 million**, but a more conservative and scientifically sound estimate made by **Robert May** places the global species diversity at about **7 million**.

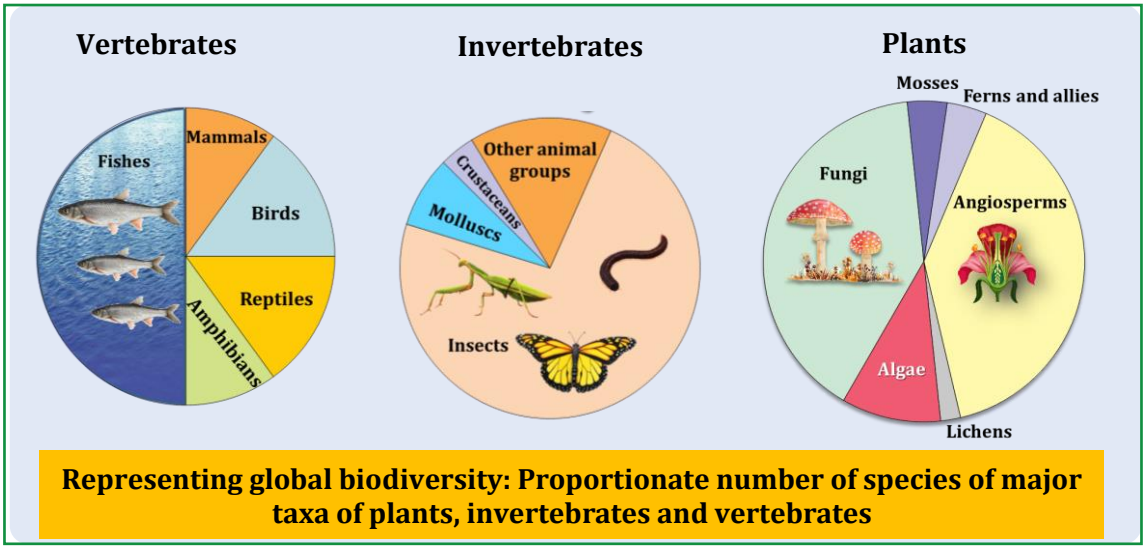
2. More than **70 per cent of** all the species recorded **are animals**, while **plants (including algae, fungi, bryophytes, gymnosperms and angiosperms)** comprise no **more than 22 per cent** of the total. Among animals, **insects are the most species-rich taxonomic group**, making up more than **70 per cent of the total**. That means, out of every 10 animals on this planet, 7 are insects. Again, **how do we explain this enormous diversification of insects?** The number of fungi species in the world is more than the combined total of the species of fishes, amphibians, reptiles and mammals. In following figure biodiversity is depicted showing species number of major taxa.

3. Although India has only **2.4 per cent** of the world's land area, its share of the global species diversity is an impressive **8.1 per cent**. That is what makes India one of the **12 mega diversity countries** of the world. Nearly 45,000 species of plants and twice as many of animals have been recorded from India. How many living species are actually there waiting to be discovered and named? If we accept May's global estimates, only **22 per cent** of the total species have been recorded so far.

70 Lakh
↓ 8.1% of global biodiversity
5,67,000 species may be in India
↓ But discovered
45,000 plants
≈ 90,000 animals

Total 135000 sp.

So, in India yet to be discovered number of Species:567000 –135000 = 432000 (approx.)



Representing global biodiversity: Proportionate number of species of major taxa of plants, invertebrates and vertebrates

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It should be noted that these estimates do not give any figures for prokaryotes. Biologists are not sure about how many prokaryotic species there might be. The problem is that –

(1) conventional taxonomic methods are not suitable for identifying microbial species and many species are simply not culturable under laboratory conditions.

(2) If we accept biochemical or molecular criteria for delineating species for this group, then their diversity alone might run into millions.

BEGINNER'S BOX-1 INTRODUCTION TO BIODIVERISITY

1. Type of Biodiversity is/are -

(1) Genetic diversity (2) Species diversity

(3) Ecological diversity (4) All of these

2. Active chemical in *Rauwolfia vomitoria* -

(1) Terpene (2) Reserpine

(3) caffeine (4) None of the above

3. The_____ Ghats have a greater amphibian species diversity than the _____ Ghats.

(1) Eastern, Western (2) Western, Eastern (3) Western, Southern (4) Eastern, Southern

4. IUCN stands for_____

(1) International union for conservation of Natural resources

(2) Indian union for conservation of Nature

(3) Italian Union for conservation at Nature

(4) International Union for conservation of Nature and Natural Resources

5. India has only _____ present at the world's land area. Its share of the global species diversity in an impressive _____ Present.

(1) 2.4, 8.1 (2) 8.1, 2.4 (3) 4.1, 8.2 (4) 8.4, 2.1

6. How many species of birds found in India?

(1) 1500 (2) 1400 (3) 1200 (4) 1700

(B) Patterns of Biodiversity :

(i) Latitudinal gradients :

The diversity of plants and animals is not uniform throughout the world but shows a rather uneven distribution. In general, species diversity decreases as we move away from the equator towards the poles. With very few exceptions, tropics (latitudinal range of 23.5° N to 23.5° S) harbour more species than temperate or polar areas. Colombia located near the equator has nearly 1,400 species of birds while New York at 41° N has 105 species and Greenland at 71° N only 56 species. **India, with much of its land area in the tropical latitudes,** has more than 1,200 species of birds. A forest in a tropical region like Ecuador has up to 10 times as many species of vascular plants as a forest of equal area in a temperate region like the Midwest of the USA.

The largely tropical Amazonian rain forest in South America has the greatest biodiversity on earth - it is home to more than 40000 species of plants, 3000 of fishes, 1300 of birds, 427 of mammals, 427 of amphibians, 378 of reptiles and more than 125000 invertebrates.

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(ii) Species-Area relationships:

German naturalist and geographer **Alexander von Humboldt observed that within a region species richness increased with increasing explored area, but only up to a limit.**

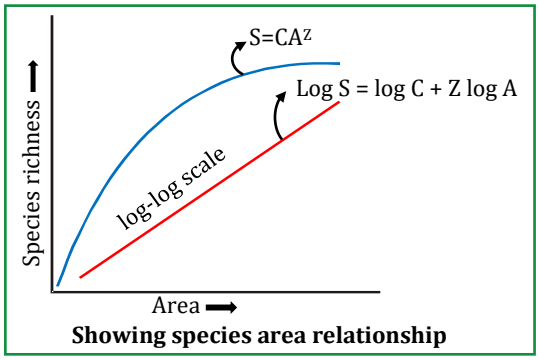
log S = log C + Z log A

where

S= Species richness A= Area

Z = slope of the line (regression coefficient)

C = Y-intercept



Showing species area relationship

Ecologists have discovered for a small region (Britain, California, New York) the value of Z lies in the range of **0.1** to **0.2**, regardless of the taxonomic group.

For very large areas like the entire continents the value of Z lies in the range of **0.6** to **1.2.** In the tropical forests of different continents for frugivorous (fruit-eating) birds and mammals value of Z found to be **1.15.**

The **steeper slopes** in this context means more species richness.

(C) The Importance of Species Diversity to the Ecosystem :

- For many decades, ecologists believed that communities with more species, generally, tend to be more stable than those with less species. What exactly is stability for a biological community?

1. A stable community should not show too much variation in productivity from year to year;
2. it must be either resistant or resilient to occasional disturbances (natural or man-made),
3. It must also be resistant to invasions by alien species.

- We don't know how these attributes are linked to species richness in a community, but **David Tilman's long-term ecosystem experiments** using outdoor plots provide some tentative answers. Tilman found that plots with more species showed less year-to-year variation in total biomass. He also showed that in his experiments, increased diversity contributed to higher productivity.
- Although, we may not understand completely how species richness contributes to the well-being of an ecosystem, we know enough to realise that rich biodiversity is not only essential for ecosystem health but imperative for the very survival of the human race on this planet.
- There are no direct answers to such naive questions but we can develop a proper perspective through an analogy (the 'rivet popper hypothesis') used by Stanford ecologist Paul Ehrlich. In an airplane (ecosystem) all parts are joined together using thousands of rivets (species). If every passenger travelling in it starts popping a rivet to take home (causing a species to become extinct), it may not affect flight safety (proper functioning of the ecosystem) initially, but as more and more rivets are removed, the plane becomes dangerously weak over a period of time. Furthermore, which rivet is removed may also be critical. Loss of rivets on the wings (key species that drive major ecosystem functions) is obviously a more serious threat to flight safety than loss of a few rivets on the seats or windows inside the plane.

(D) Causes of Biodiversity Losses :

The accelerated rates of species extinctions that the world is facing now are largely due to human activities. There are four major causes ('**The Evil Quartet**' is the sobriquet used to describe them).

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(i) Habitat loss and fragmentation:

This is the most important cause driving animals and plants to extinction. The most dramatic examples of habitat loss come from tropical rain forests. Once covering more than 14 per cent of the earth's land surface, these rain forests now cover no more than 6 per cent. They are being destroyed fast. The Amazon rain forest (it is so huge that it is called the **'lungs of the planet'**) harbouring probably millions of species is being cut and cleared for cultivating soya beans or for conversion to grasslands for raising beef cattle.

Besides total loss, the degradation of many habitats by pollution also threatens the survival of many species. When large habitats are broken up into small fragments due to various human activities, mammals and birds requiring large territories and certain animals with migratory habits are badly affected, leading to population declines.

(ii) Over-exploitation : Humans have always depended on nature for food and shelter, but when 'need' turns to 'greed', it leads to over-exploitation of natural resources. Many species extinctions in the last 500 years **(Steller's sea cow, passenger pigeon)** were due to overexploitation by humans. Presently many marine fish populations around the world are over harvested, endangering the continued existence of some commercially important species.

(iii) Alien species invasions : When alien species are introduced unintentionally or deliberately for whatever purpose, some of them turn invasive, and cause decline or extinction of indigenous species. The **Nile perch** introduced into Lake Victoria in east Africa led eventually to the extinction of an ecologically unique assemblage of more than 200 species of **cichlid fish** in the lake.

You must be familiar with the environmental damage caused and threat posed to our native species by invasive weed species like carrot grass **(Parthenium)**, Lantana and water hyacinth (**Eicchornia**). The recent illegal introduction of the **African catfish Clarias gariepinus** for aquaculture purposes is posing a threat to the indigenous catfishes in our rivers.

(iv) Co-extinctions : When a species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct. When a host fish species becomes extinct, its unique assemblage of parasites also meets the same fate. Another example is the case of a coevolved plant-pollinator **mutualism** where extinction of one invariably leads to the extinction of the other.

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Type of Extinction of species :

(a) Natural extinction : Due to change in environmental condition.

(b) Mass extinction : Due to catastrophe.

(c) Anthropogenic extinction : Due to human activities like hunting.

The characteristics of species particularly susceptible to extinction are :

Large body size, small population size, low reproductive rate, feeding at high trophic levels in the food chain, Fixed migratory routes and habitat and localized and narrow range of distribution.

(E) Why Should we Conserve Biodiversity :

There are many reasons to conserve biodiversity we can group then into three categories.

(i) Narrowly utilitarian :- It is concerned with direct economic benefits from nature food, firewood, fibre, construction material, industrial products and products of medicinal importance. More than **25 percent** of the drugs currently sold in the market world wide are derived from plants.

(ii) Broadly Utilitarian :-

It is concentred with indirect benefits from nature, like, photosynthesis, pollination. This argument says that biodiversity plays a major role in many ecosystem services that nature provides Amazon forest is estimated to produce **20% of the total oxygen** in the earth's atmosphere pollination is another Service, ecosystem provide through insects.

(iii) Ethical :-

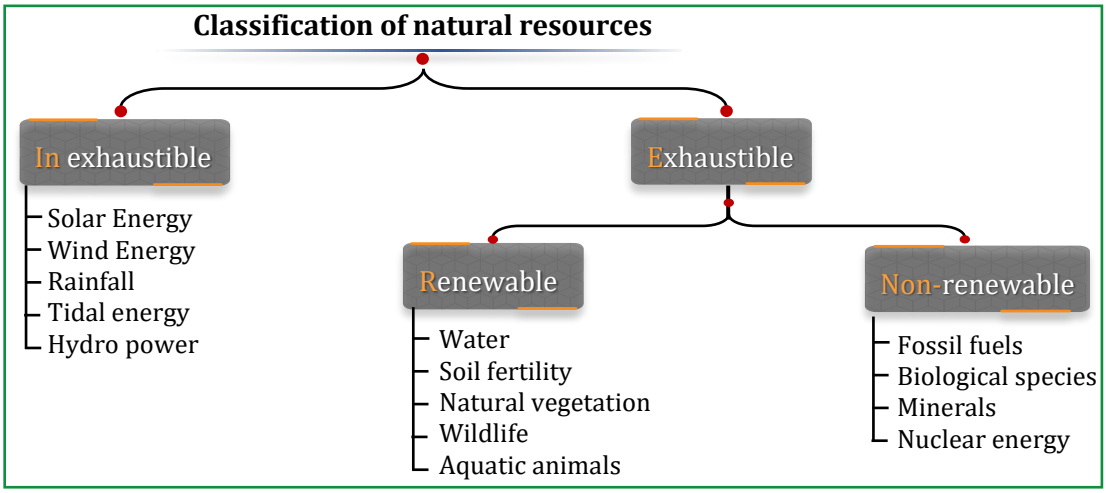
It is our moral duty to care for the well being of biodiversity and pass on our biological legacy in good order to future generations.

Note : **Bioprospecting :-** Exploring molecular, genetic and species level diversity for the products of economic importance.

2. Natural Resources :

The materials or any component, that can be utilised by man and are necessary for welfare of life, which is available in the natural environment in Atmosphere, Hydrosphere, Lithosphere is called natural resources.

e.g. O_2, Land, Soil, Water, Forest, Animals, Soil, microorganism



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Classification of natural resources :

1. **Inexhaustible resources (Non-conventional resources) :** Available in unlimited quantities, and the earth quantity may remain unchanged by human impact.
   e.g. Solar Energy, Wind Power, Tidal power, Air, Geothermal Energy
   Note : Its quality can be affected due to continuous increase in human population.
   e.g. Air pollution
2. **Exhaustible resources (Conventional resources) :**
   These are likely to be finished by human use or unsustainable uses.

It is further divided in two groups :

(i) **Renewable resources :** Those which are being continuously consumed by man but renewed continuously by nature, always available if managed in a proper way, otherwise they may even get totally exhausted.
e.g. Biotic resources, forest, grazing animals, Rangeland, wild life, Agriculture crop system and fresh water yield, soil etc.

(ii) **Non renewable resources :** They are not renewable after use and are not replaced by nature, can not be regained.
e.g. Fossil fuel (Coal, Petroleum), Natural Gas, Nuclear energy, Biotic species, Minerals etc.
Note : Nuclear energy is non renewable and unlimited resources.

Hydrosphere or Water Resources :

The total volume of water in the hydrosphere is 1.4 billion cubic kilometres [Km^3], about **97.5%** is the **ocean water**, unsuitable for human use. Only **2.5%** is available as **fresh water**. About **1.97%** is stored in **ice-caps** (Polar ice) and glaciers and 0.5% is ground water and soil moisture (0.01%). The rest [about 0.03 percent] is distributed in lakes swamps, rivers and streams.

Land Resources

At the beginning of 20th century, about **30%** of land in India was covered with forest but the end of the 20th century, the forest cover reduced to **21.54%**. Out of 21.54%, only **12%** area covered by dense forest.

- Per capita forest area available in India is = **0.06** hec.
- Per capita forest area available in world is = **0.64** hec.

3. Forest Conservation :

It is conducted by two methods

1. Protection or conservation forestry : By Making national park and Bio-sphere Reserve.

2. Production or commercial forestry :

It is of two types :

(i) **Social forestry :** To grow the trees and shrubs on unused farmland, road sides, Rail sides, community land etc.

(ii) **Agro-forestry :** Woody species are grown in combination with herbaceous crops either at the same time or in time sequence.

Silent Valley : It is tropical evergreen forest in Kerela (Palghat) declared as National Reserve Forest. It is called silent valley because there is no noise in the forest during night, even that of cicadas, as they are not found there. **It is related to conservation of forest.**

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(A) Case Study of People's Participation in Conservation of Forests :

- People's participation has a long history in India. In **1731**, the king of **Jodhpur in Rajasthan** asked one of his ministers to arrange wood for constructing a new palace. The minister and workers went to a forest near a village, inhabited by Bishnois, to cut down trees. The Bishnoi community is known for its peaceful co-existence with nature. The effort to cut down trees by the kings was thwarted by the Bishnois. A Bishnoi woman **Amrita Devi** showed exemplary courage by hugging a tree and daring king's men to cut her first before cutting the tree. The tree matiered much more the her than her own life. Sadly, the king's men did not heed to her pleas, and cut down the tree along with Amrita Devi. Her three daughters and hundreds of other Bishnois followed her, and thus lost their lives saving trees.
- The Government of India has recently instituted the **Amrita Devi Bishnoi Wildlife Protection Award** for individuals or communities from rural areas that has shown extraordinary courage and dedication in protecting wildlife.
- You may have heard of the **Chipko Movement** of Garhwal Himalayas. In **1974**, local women showed enormous bravery in protecting trees from the axe of contractors by hugging them.
- **Chipko Movement** was born in March-1974 at Gopeshwar in Chamoli district. The movement had two leaders- Sundarlal Bahuguna of Silyara in Tehri and Chandi Prasad Bhatt of Gopeshwar. It was for plant conservation.
- Realising the significance of participation by local communities, the Government of India **1980s** has introduced the concept of **Joint Forest Management (JFM)** so as to work closely with the **local communities** for protecting and managing get benefit of various forest products (**e.g.**, fruits, gum, rubber, medicine etc.) and thus the forest can be conserved in a sustainable manner.

4. How We Conserve Biodiversity:

When we conserve and protect the whole ecosystem, its biodiversity at all levels is protected - we save the entire forest to save the tiger. This approach is called in situ (on site) conservation. However, when there are situations where an animal or plant is endangered or threatened (organisms facing a very high risk of extinction in the wild in the near future) and needs urgent measures to save it from extinction, ex-situ (off site) conservation is the desirable approach.

(A) In-Situ Conservation :

1. **Hot Spot :** Norman Myers developed the hot spot concept in 1988. This is a mega diversity zone. Where large number of species are found. It is an area of the richest and the most threatened reservoirs of plant and animal life on the earth. Initially 25 biodiversity hot spots were identified in world, now **number of biodiversity hot spot in the world are 34 out of these 3 hotspots are found in India**.
   (i) Western Ghats and Sri Lanka
   (ii) Indo-Burma
   (iii) The Himalayas

Note :

- The key criteria for determining a hot spot are :
  1. High level of species richness
  2. High degree of endemism (that is, species confined to that region and not found anywhere else)

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3. High degree of threat which is measured in terms of habitat loss (It means hot spots are regions of accelerated habitat loss).

- Hot spot covers the 1.4% of the earths land area.
- Although all the biodiversity hotspots put together cover less than 2 percent of the earth's land area, the number of species they collectively harbour is extremely high and strict protection of these hotspots could reduce the ongoing mass extinctions by almost 30 per cent.

2. Biosphere Reserves : It is a specified protected area in which multiple use of the land is permitted. There are 3 zones of Biosphere Reserve.

1. Core Zone : It lies at the centre where no human activity is allowed.

2. The Buffer zone : Where limited human activity is allowed.

3. Manipulating zone or Transition zone : Where a large number of human activities would go on.

Note : 408 Biosphere reserves are located in 94 countries out of which 14 sites are present in India. In India following 14 sites have been identified as potential biosphere reserves together with their locations:

S.No.	Biosphere Reserve	State(s)
1.	Nanda Devi	Uttaranchal/Uttarakhand
2.	Nokrek	Meghalaya
3.	Manas	Assam
4.	Dibru Saikhowa	Assam
5.	Dehang Debang	Arunachal Pradesh
6.	Sunderbans	West Bengal
7.	Gulf of Mannar	Tamil Nadu
8.	Nilgiri	Kerala, Karnataka and Tamil Nadu
9.	Great Nicobar	Andaman & Nicobar
10.	Simlipal	Orissa
11.	Kanchanjunga	Sikkim
12.	Pachmarhi	Madhya Pradesh
13.	Agasthyamalai	Kerala
14.	Achankamar	Madhya Pradesh, Chattisgarh

3. National Park and Sanctuaries :

- In India, ecologically unique and biodiversity-rich regions are legally protected as biosphere reserves, national parks and sanctuaries. India now has **14** biosphere reserves, **90** national parks and **448** wildlife sanctuaries. India has also a history of religious and cultural traditions that emphasised protection of nature.
- In many cultures, tracts of forest were set aside, and all the trees and wildlife within were venerated and given total protection. Such sacred groves are found in Khasi and Jaintia Hills in Meghalaya, Aravalli Hills of Rajasthan, Western Ghat regions of Karnataka and Maharashtra and the Sarguja, Chanda and Bastar areas of Madhya Pradesh. In Meghalaya, the **sacred groves** are the last refuges for a large number of rare and threatened plants.

Some Important National Parks of India

S.No.	Name & Location	IMPORTANT ANIMALS FOUND
1.	Kaziranga National Park District Sibsagar(Assam)	Rhinoceros
2.	Sundarbans (Tiger Reserve) 24-Pargana (West Bengal)	Tiger
3.	Hazaribagh National Park Hazaribagh Jharkhand	Tiger
4.	Corbett National Park District Nainital (Uttaranchal)	Tiger
5.	Gir National Park District Junagarh (Gujarat)	Asiatic lion
6.	Kanha National Park Mandla and Balaghat (Madhya Pradesh)	Tiger, panther, chital, chinkara, four horned deer
7.	Tandoba National Park Chandrapur (Maharashtra)	Tiger
8.	Bandipur National Park District Mysore (Karnataka)	Elephant, tiger, leopard
9.	Desert National Park Jaisalmer, Barmer (Rajasthan)	Great Indian Bustard, Black buck, Chinkara.
10.	Nanda Devi - Uttaranchal/Uttarakhand (Chamoli District)	Rhinoceros
11.	Kuno National Park – Sheopur (Madhya Pradesh)	Cheetah (brought from Namibia)

Some Important Sanctuaries of India

S.No.	Name & Location	IMPORTANT ANIMALS FOUND
1.	Keoladeo Ghana Bird Sanctuary Bharatpur (Rajasthan) Famous for birds	Siberian crane
2.	Annamalai Sanctuary Coimbatore (Tamil Nadu)	Tiger, Elephant
3.	Dachigam Sanctuary Srinagar (Jammu & Kashmir)	Hangul or Kashmir stag, Musk deer
4.	Nagarjuna Sagar Sanctuary Guntur Kamool and Nalgonda (Andhra Pradesh)	Tiger, Panther
5.	Periyar Sanctuary (Kerala)	Elephants, Leopard, Hornbill
6.	Chilka Lake Bird Sanctuary Balagaon (Orissa) (Largest brackish water lagoon in Asia)	Water fowls, Ducks, Cranes
7.	Manas Wildlife Sanctuary Kamrup (Assam)	Tiger, Panther

4. Sacred Groves :

In many cultures, tracts of forest were set aside, and all the trees and wildlife within were venerated and given total protection. Such **sacred groves** are found in **Khasi and Jaintia Hills in Meghalaya, Aravalli Hills of Rajasthan, Western Ghat regions of Karnataka and Maharashtra and the Sarguja, Chanda and Bastar areas of Madhya Pradesh.** In Meghalaya, the sacred groves are the last refuges for a large number of rare and threatened plants.

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(B) Ex-Situ conservation :

- The protection of wild life in zoos and botanical gardens. Other e.g., of Ex-situ conservation are **gene banks, germ plasm bank, seed bank**. In this approach, threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care. **Zoological parks, botanical gardens** and **wildlife safari parks** serve this purpose. There are many animals that have become extinct in the wild but continue to be maintained in zoological parks.
- In recent years ex situ conservation has advanced beyond keeping threatened species in enclosures. Now gametes of threatened species can be preserved in viable and fertile condition for long periods using **cryopreservation techniques**, eggs can be fertilised in vitro, and plants can be propagated using tissue culture methods. Seeds of different genetic strains of commercially important plants can be kept for long periods in seed banks.
- Biodiversity knows no political boundaries and its conservation is therefore a collective responsibility of all nations. The historic Convention on Biological Diversity ('The Earth Summit') held in Rio de Janeiro in 1992, called upon all nations to take appropriate measures for conservation of biodiversity and sustainable utilisation of its benefits. In a follow-up, the World Summit on Sustainable Development held in 2002 in Johannesburg, South Africa, 190 countries pledged their commitment to achieve by 2010, a significant reduction in the current rate of biodiversity loss at global, regional and local levels.

Some Important Informations :

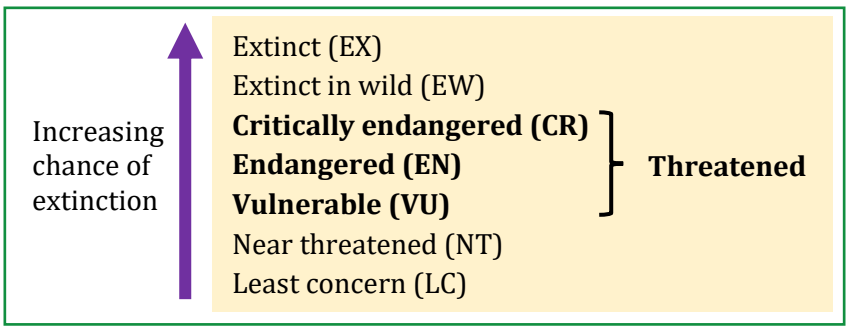
(i) **National Forest Policy – 1988**
(ii) Biodiversity act of India was passed by the Parliament in the year-2002
(iii) Forest Act–1927
(iv) Biosphere Reserve Scheme– 1986
(v) **Wildlife protection act 1972 (Revised in 1991)**

About Wildlife :

- **Red Data Book :-** This book contains a record of **animals & plants** which are known to be in danger. This Book is maintained by the **IUCN** [International Union for Conservation of Nature and Natural Resources].

Concept of threatened species

A threatened species is any species which is vulnerable, endangered, or critically endangered.



(C) Criteria for a Threatened Species: some of them are

1. Population size decline
2. Number of mature individuals
3. Geographic range of distribution

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Some threatened species

Some important examples of threatened species in india

S.No.	Category	Plants	Animals
(1)	Critically endangered	*Barberis nilghiriensis*	*Sus salvanius* (Pygmyhog), Siberian Crane, The Great Indian Bustard
(2)	Endangered	*Bentinckia nicobarica, Rauwolfia serpentiana,* Asiatic wild ass, Hangul–Kashmir Stag,	*Ailurus fulgens* (Red panda), Hornbill and Indian Aconite
(3)	Vulnerable	*Cupressus cashmeriana*	*Antelope cervicapra* (Black buck)

- **Asiatic wild ass – (Endangered) –** Found in Runn of Kutch and Pakistan
- **Red Panda – (Endangered) –** Found in Kanchanjunga (Sikkim)
- **Hangul–Kashmir Stag (Endangered) –** Found in Dachigam (Srinagar – Jammu & Kashmir)
- **Siberian Crane (Critically Endangered) –** Found in Keoladeo (Ghana) National Park Bharatpur (Rajasthan).
- **The Great Indian Bustard (Critically Endangered)** is a huge ground bird with a long neck and long bare legs. It is an inhabitant of the semi-arid areas of Rajasthan, Gujarat and Maharashtra.

5. Some Other Information About Biodiversity :

(A) Diversity at the level of community – Three types :

(i) **Alpha diversity :** Diversity within community.

(ii) **Beta diversity :** Diversity between community.

(iii) **Gamma diversity :** Diversity of the habitats over the total landscape or geographical area.

(B) India is Divided into 10 Biogeographical Regions :

(C) **Wetlands :** Low lying area's covered with shallow water are called wet land's. The wet lands are transitional zones between terrestrial and aquatic area's. 6% of the world's land surface is occupy by wet lands. For wetland conservation Ramser Convention was held in Iran.

(i) **Marshes :** Wetlands where grass - like plants dominate.

(ii) **Swamps :** Wetlands where trees or shrubs dominate.

(iii) **Reverine forest :** Periodically Flooded forests found in lowland along streams.

(iv) **Mangrove is salty water swamp**

Significance of wet lands :

- Wetland are highly productive, provide food and habitat.
- Wetlands helps to control flooding by holding excess water.
- Ground water recharging areas.
- Help to clean and purify water run-off.
- Provides sites for fishing, boating, nature study.

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6. Important Days About Environment :

02-Feb	—	World Wetland day
03-Mar	—	World wild life day
22-Mar	—	World water day
22-Apr	**—**	**Earth Day**
09-May	—	International migratory Bird Day
22-May	—	International Day for Biological Diversity
05-Jun	**—**	**World Environment Day**
08-Jun	—	World ocean Day
11-Jul	**—**	**World population Day**
23-28 August	—	World water week
16-Sep	**—**	**World Ozone day**
04-Oct	—	World Animal Day
21-Mar	—	World Forest Day
23-Mar	—	World Resources Day
10-Apr	—	World Atmosphere Day
02-08 Oct	—	Wild life Week
14-Dec	—	World Energy Conservation Day
02-Dec	—	National Pollutions prevention Day (National Environment Day)
03-Dec	**—**	**Bhopal Tragedy Day**

★ Golden Key Points ★

- Most important levels of biodiversity are genetic, species and ecological diversity.
- Conservative and scientifically sound estimate made by Robert May places global species diversity at about 7 million.
- There are two methods of conservation –
- In situ (conservation in natural habitat) and
- ex situ (conservation outside natural habitat)
- In general, species diversity decreases as we move away from the equator towards poles. Also, within a region species richness increases with increasing explored area, but only up to a limit.
- The four major causes of biodiversity loss "the evil quarted" includes habitat loss and fragmentation, over exploitation, Alien species invasion and co-extinction.
- Joint forest management was launched in 1980s

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BEGINNER'S BOX-2 BIODIVERISITY AND CONSERVATION

1. Species extinct in the wild are maintained in which of the following conservation site ?
(1) Zoological parks (2) Biosphere reserves
(3) Hot spot (4) National parks

2. Which of the following is broadly utilitarian role of ecosystem ?
(1) Dyes (2) Medicines
(3) Oxygen (4) Fire wood

3. Who popularised the term biodiversity ?
(1) David Tilman (2) Edward Wilson
(3) Paul Ehrlich (4) Alexander Von Hombolt

4. Which taxonomic group is more vulnerable to extinction ?
(1) Amphibian (2) Mammal
(3) Aves (4) Fishes

5. More species in community, tends to more stability than communities with less species'. It was supported by–
(1) David Tilman (2) Paul Ehrlich
(3) Humboldt (4) Both (1) and (2)

BEGINNER'S BOX ANSWERS KEY

BEGINNER'S BOX-1	Que.	1	2	3	4	5	6
	Ans.	4	2	2	4	1	3

BEGINNER'S BOX-2	Que.	1	2	3	4	5
	Ans.	1	3	2	1	1

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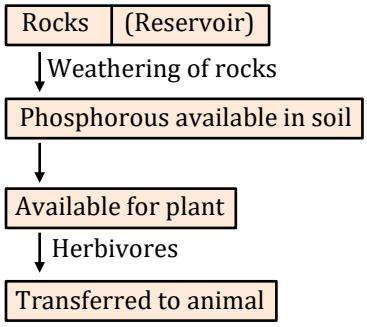
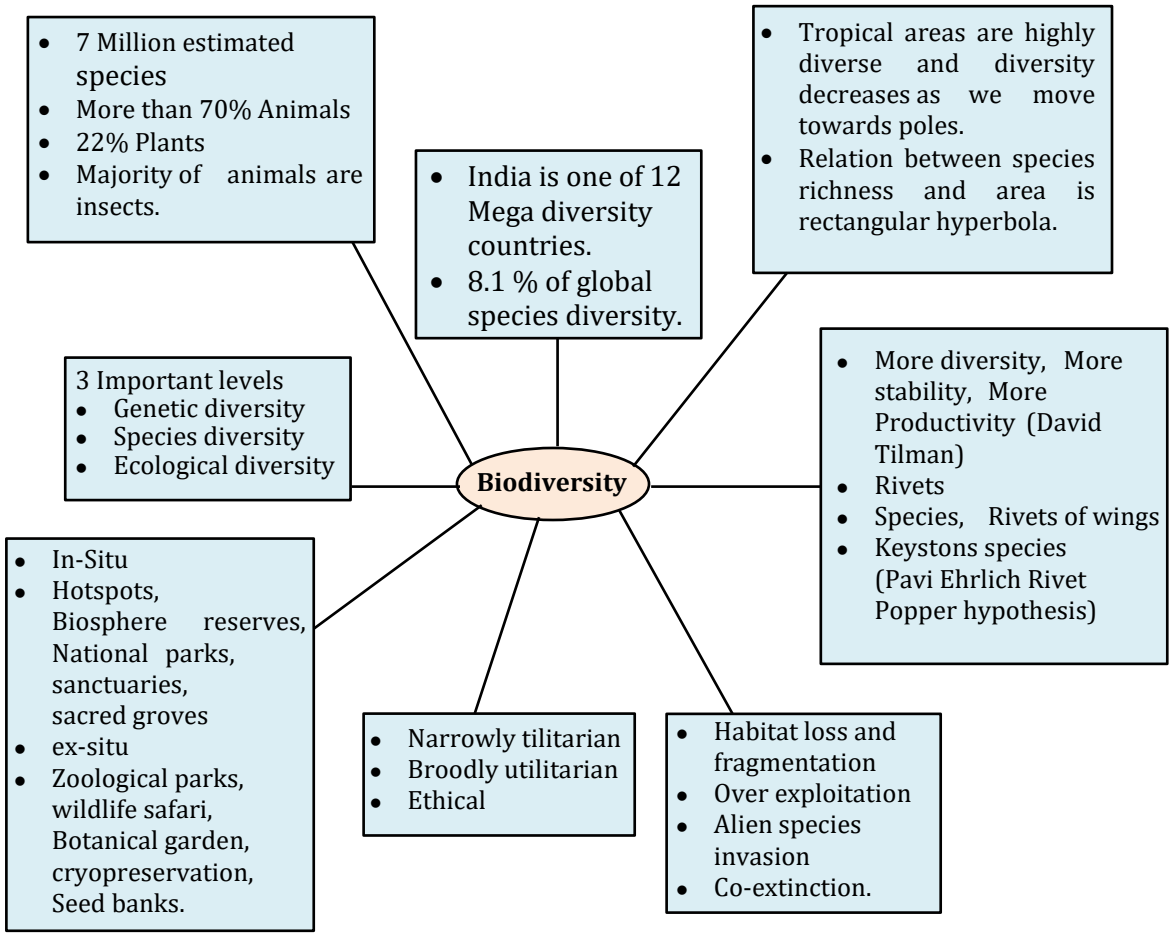
Phosphorus cycle :-




7 Million estimated species
More than 70% Animals
22% Plants
Majority of animals are insects.
India is one of 12 Mega diversity countries.
8.1 % of global species diversity.
Tropical areas are highly diverse and diversity decreases as we move towards poles.
Relation between species richness and area is rectangular hyperbola.
3 Important levels
Genetic diversity
Species diversity
Ecological diversity
Biodiversity
More diversity, More stability, More Productivity (David Tilman)
Rivets
Species, Rivets of wings
Keystons species (Pavi Ehrlich Rivet Popper hypothesis)
In-Situ
Hotspots, Biosphere reserves, National parks, sanctuaries, sacred groves
ex-situ
Zoological parks, wildlife safari, Botanical garden, cryopreservation, Seed banks.
Narrowly tilitarian
Broodly utilitarian
Ethical
Habitat loss and fragmentation
Over exploitation
Alien species invasion
Co-extinction.

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